



**U.S. Army
Chemical Materials Agency
Anniston Chemical Activity**



ANCDF EDT

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Static Detonation Chamber (SDC)



Background: Lesson Learned from Tooele Chemical Agent Disposal Facility August 10, 2008. Tooele Chemical Agent Disposal Facility had to “suspend” their 155mm Mustard Campaign with 198 problematic munitions with no reasonable safe path forward for processing.

Anniston Mustard filled inventory is old and in poor condition.

- Some Mortar Fuzes have corroded and separated from the munition body while in storage.

Anniston Chemical Agent Disposal Facility decided to pursue other methods to process Over-Packed and problematic munitions by attempting to reduce Operator manual interaction to process the projectiles.

Employ a Static Detonation Chamber to address problematic munitions.

Chose Dynasafe Unit as best value to meet Anniston Chemical Agent Disposal Facility needs.



Why ANCDF needs EDT

Process munitions that are not amenable to reverse disassembly



These photos are of a 155mm mustard projectile where a cavity cut has been performed to attempt to remove the Burster and Bursterwell. The Bursterwell broke approximately in half leaving the fully intact Burster inside the agent cavity.



Candidate Munitions - Procurement Basis

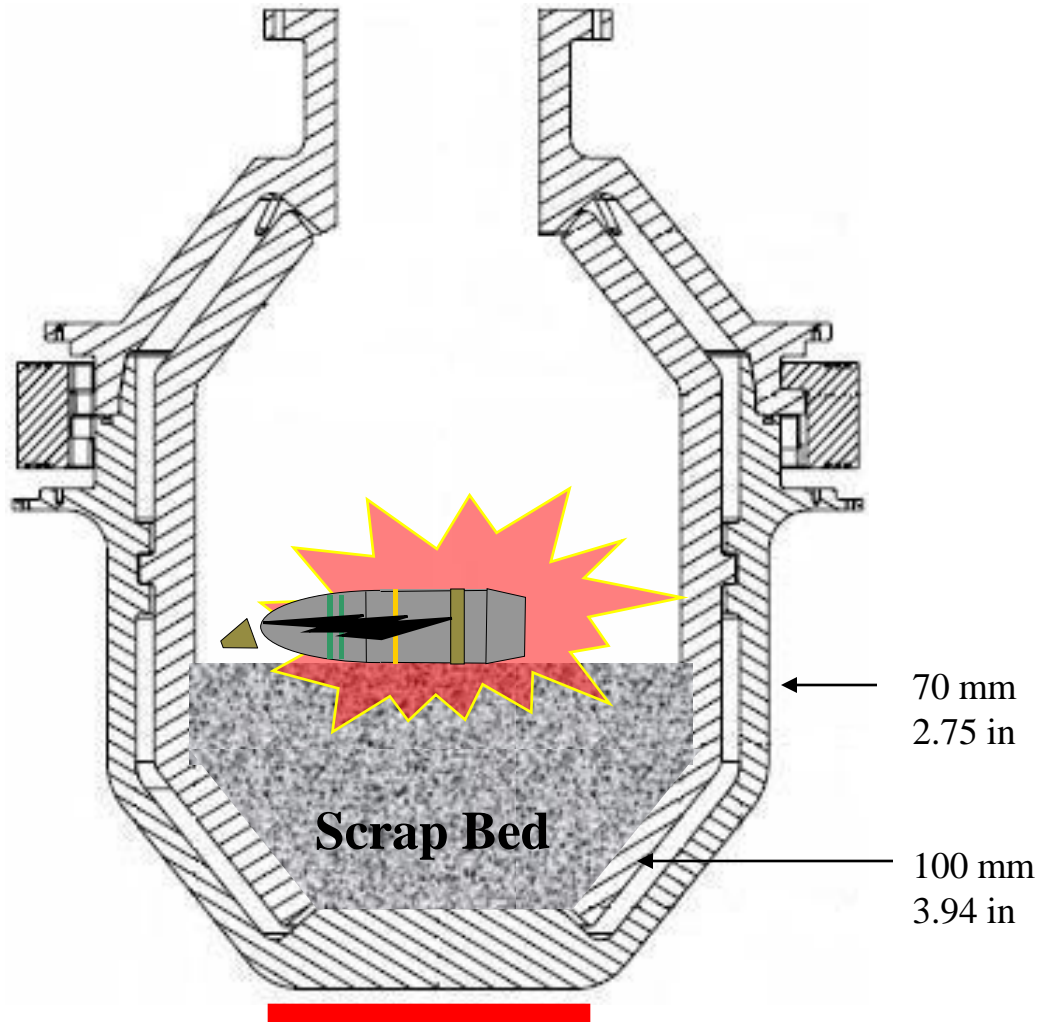
Site	Item	OP	Assumption/Basis
ANCDF	4.2 inch mortars leakers	174	Existing leakers. 163 still contain propellant
	4.2 inch process rejects	2589	Projected at 1% rate.
	105mm leakers	73	Existing leakers.
	105mm process rejects	83	Projected at .36% rate.
	155mm rejects	64	Includes projected rejects and rejects based on stockpile information.



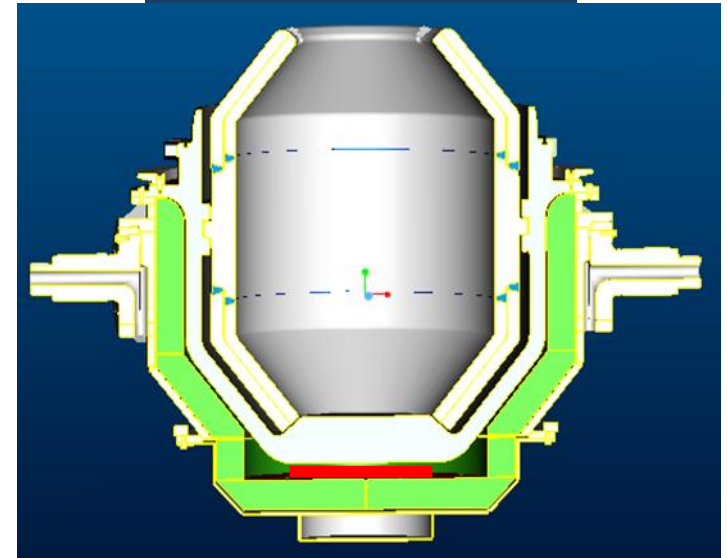
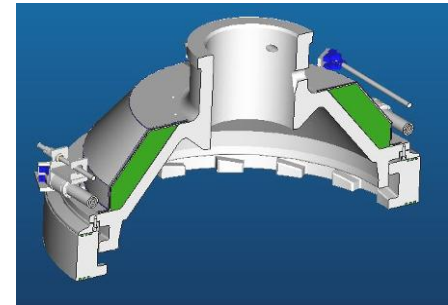
- The Static Detonation Chamber (SDC) is a heated, armored, double shell retort, which operates at high temperature ($538^{\circ} C.$, $1000^{\circ} F.$).
- Can process both conventional and chemical agent filled munitions.
- The inner chamber is a heat resistant stainless steel with excellent tensile properties at high temperatures.
- The wall thickness is much greater than required by the mechanical stress loads caused by detonation pressures.



Static Detonation Chamber Cut Away



Double Walled / Air Space
Insulation
Electrical Heat Elements





Before 105mm Munitions Enter SDC





After 155mm Munitions Exit SDC





After 155mm Munitions Exit SDC





- Award Date - October 30, 2009
- Design Complete - December 2009
- Tested in Sweden - May 2010
- Delivered to ANCDF - July 2010
- Begin Commissioning Testing - September 2010
- Start Conventional Shakedown - November 2010
- Systemization Complete - December 2010
- Began Chemical Operations - March 2011

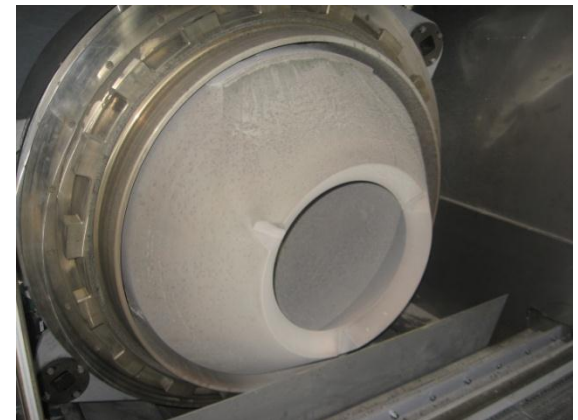


Static Detonation Chamber (SDC)





Detonation Chamber unlocks and rotates to empty scrap





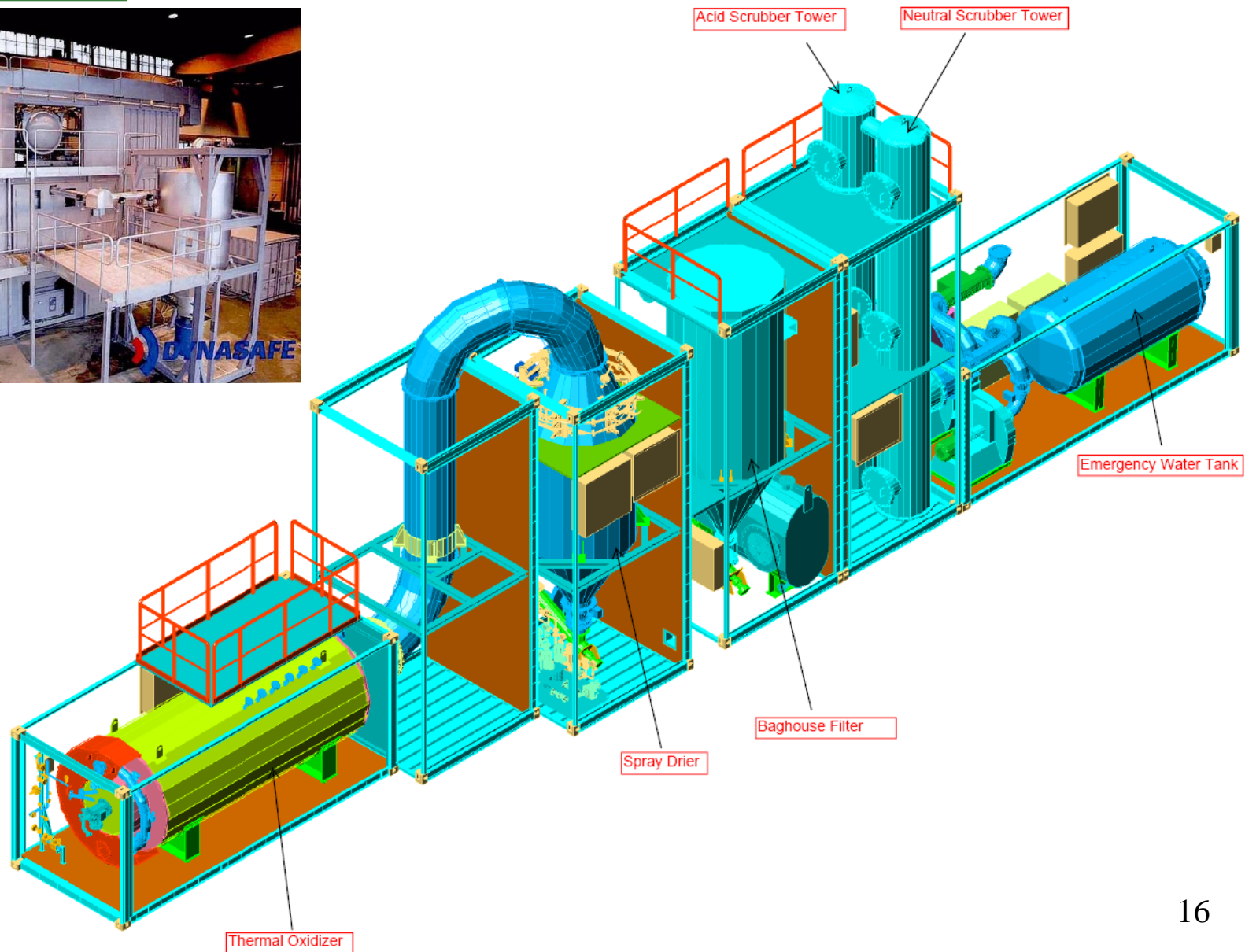
Static Detonation Chamber (SDC)





Static Detonation Chamber Pollution Abatement System to Control Emissions

- Thermal Oxidizer
- Buffer Tank
 - designed to smooth gas pressure and volume surges after the detonation or deflagration of a munition
 - also acts as a cyclone which allows for the removal of large particle ash and small metal pieces from detonations
- Quench
 - cools down the air stream
- Dry Scrubber/Particulate Filter
 - removes most of the dust as well as some volatile and semi volatile heavy metals.
- Acid Scrubber
 - removes residual fine solid particles, acid gases including chlorine, hydrogen, a portion of sulfur dioxide gases, and volatile and semi volatile heavy metals
- Neutral Scrubber
 - removes residual chlorine and heavy metals from the air stream
- Activated Carbon Filtration System (during chemical agent processing)
 - serves as a backup for the Pollution Abatement System in the event the system malfunctions
- Sprung structure enclosure and carbon filter
 - required for chemical weapons processing





- **The SDC is designed with a primary, secondary and tertiary containment.**
- Primary is the detonation chamber and piping to the Thermal oxidizer.
- Secondary containment is the containers and guard piping around the detonation chamber.
- Tertiary containment is the sprung structure.
- All three containments are protected by charcoal filtration and the secondary and tertiary containments are maintained at a negative pressure.



- 4 - M692 ADAM HE ISS Projectiles
- 96 - M86 PDM Mines
- 40 - M74 AP Mines
- 5,040 - CTG, 20mm HE 5
- 1,261 - Simulatory Flash Arty M21
- 428 - Signal Smoke & Illum. MK13
- 840 - CTG 40mm Red Smoke M713
- 420 - CTG 60mm HE M49A4
- 926 - CTG 60mm HE M49A2



Normal Configuration

- 4.2 inch HT rounds - 178
- 4.2 inch HD rounds - 144
- 105mm HD M60 non-fused - 36
- 105mm HD M60 w/M57 fused - 2088
- 155mm HD M110 - 22

Overpacks

- 4.2 inch HT rounds - 146
- 4.2 inch HD rounds - 49
- 105mm HD M60 non-fused - 269 105mm HD
M60 w/M57 fused - 4
- 155mm HD M110 - 1



- The SDC has performed five emissions tests.
 - Two with conventional munitions.
 - One with Surrogate material.
 - Two with Chemical munitions.
- The SDC met all emissions requirements and demonstrated a Mustard agent feed rate of 56.3 pounds per hour.



- Emissions Data

- All compliance objectives were met
- Sulfur-impregnated carbon (SIC) used in the Safeguard Filter Unit (SFU)
- Average Mustard Feed Rate - 33.6 lbs/hr
- Average Energetic Feed Rate - 2.9 lbs/hr
- DRE achieved for 3 replicate runs - >99.999998 (ND) for mustard
- Maximum Carbon Monoxide (CO) hourly rolling average - 9.01 ppmv@7% O₂ (permit limit 100)
- Average of the Average CO - 0.0056 lbs/hr (permit limit 0.02)
- Maximum Dioxins/Furans - 0.0052 ng-TEQ/dscm@7% O₂ (permit limit 0.2)
- Volatiles/Semi-volatiles - non detect or $\leq E-06$ (exception benzoic acid - $\leq E-05$)



- Emissions Data (Continued)
 - Maximum Chloride Equivalents - $<0.56 \text{ ppmv@7\% O}_2$ (permit limit 21)
 - Maximum Particulates - $0.00048 \text{ gr/dscf@7\% O}_2$ (permit limit 0.013)
 - Maximum Arsenic/Beryllium/Chromium - $2.12 \text{ ug/dscm@7\% O}_2$ (permit limit 23)
 - Maximum Cadmium/Lead - $0.55 \text{ ug/dscm@7\% O}_2$ (permit limit 10)
 - Maximum Mercury - $2.41 \text{ ug/dscm@7\% O}_2$ (permit limit 8.1)
 - Average Mercury Concentration - $<0.75 \text{ ug/dscm}$ (2 orders of magnitude less than conventional w/o carbon)
 - Average Mercury Emission - $<2.22\text{E-}07 \text{ g/s}$ (2 orders of magnitude less than conventional w/o carbon)
 - Energetics - All runs/All compounds were non detect



- Emissions Data

- All compliance objectives were met
- Sulfur-impregnated carbon (SIC) used in the Safeguard Filter Unit (SFU)
- Average Mustard Feed Rate - 56.65 lbs/hr
- Average Energetic Feed Rate - 4.29 lbs/hr
- DRE achieved for 3 replicate runs - >99.9999991 (ND) for mustard
- Maximum Carbon Monoxide (CO) hourly rolling average - 1.04 ppmv@7% O₂ (permit limit 100)
- Average of the Average CO - 0.0044 lbs/hr (permit limit 0.02)
- Maximum Dioxins/Furans - 0.0074 ng-TEQ/dscm@7% O₂ (permit limit 0.2)
- Volatiles/Semi-volatiles - ≤E-06 (exceptions: acetone, chloroform, carbon tetrachloride, methylene chloride, & benzoic acid - ≤E-05)



- Emissions Data (continued)

- Maximum Chloride Equivalents - $<0.47 \text{ ppmv@7\% O}_2$ (permit limit 21)
- Maximum Particulates - $0.00074 \text{ gr/dscf@7\% O}_2$ (permit limit 0.013)
- Maximum Arsenic/Beryllium/Chromium - $3.061 \text{ ug/dscm@7\% O}_2$ (permit limit 23)
- Maximum Cadmium/Lead - $0.46 \text{ ug/dscm@7\% O}_2$ (permit limit 10)
- Maximum Mercury - $2.14 \text{ ug/dscm@7\% O}_2$ (permit limit 8.1)
- Average Mercury Concentration - $<1.20 \text{ ug/dscm}$ (2 orders of magnitude less than conventional w/o carbon)
- Average Mercury Emission - $<2.81\text{E-}07 \text{ g/s}$ (2 orders of magnitude less than conventional w/o carbon)
- Energetics - All runs/All compounds were non detect



- **SDC Challenges have been in several broad categories:**
- Agent migration into secondary containment
- CO generation during processing
- Rapid loading and depletion of the process charcoal filters
- System reliability



ANCDF Demilitarization Protective Ensemble





Questions?